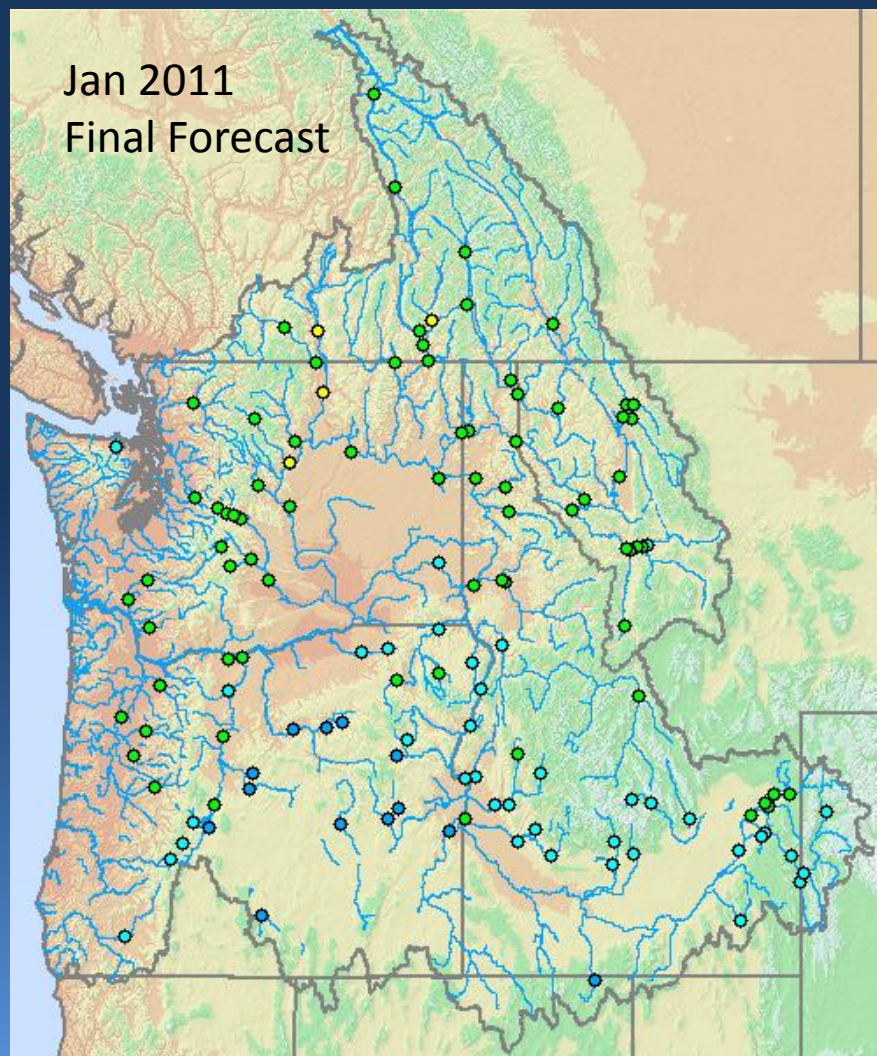




Northwest River Forecast Center Water Supply Briefing



Water Supply Forecast (% Avg)

□	No Average, No data
■	< 25
■	25-50
■	50-75
■	75-90
■	90-110
■	110-125
■	125-150
■	150-175
■	> 175

Jan 1st "Final" Forecast

Legacy Regression Model

Agency Coordinated

Precipitation Forecast:
100% of Normal

NWRFC Forecast used in Canada



Observed Conditions



Precipitation

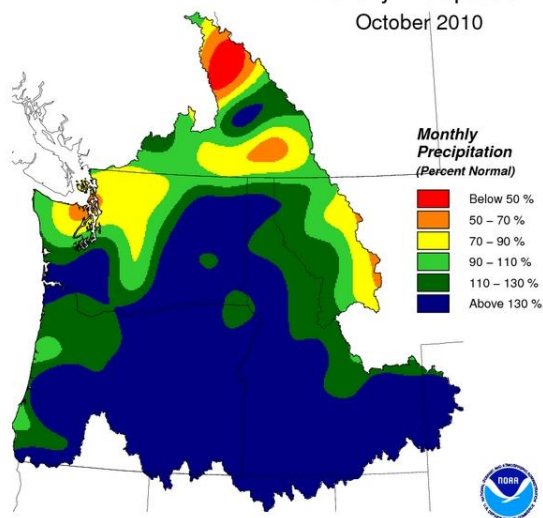
Snowpack



Observed Monthly Precipitation



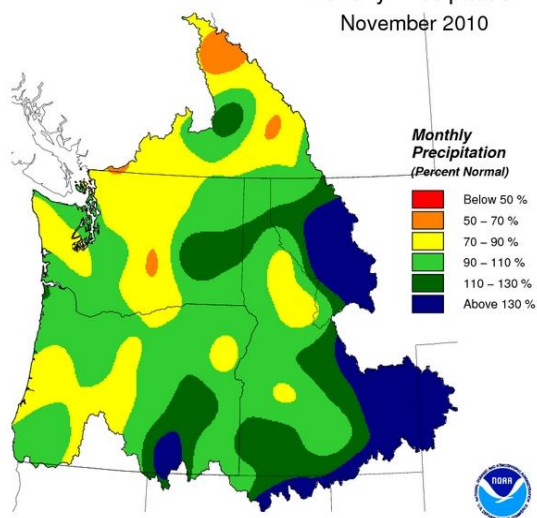
Monthly Precipitation
October 2010



Creation Time: Fri, Nov 5, 2010

Northwest River Forecast Center

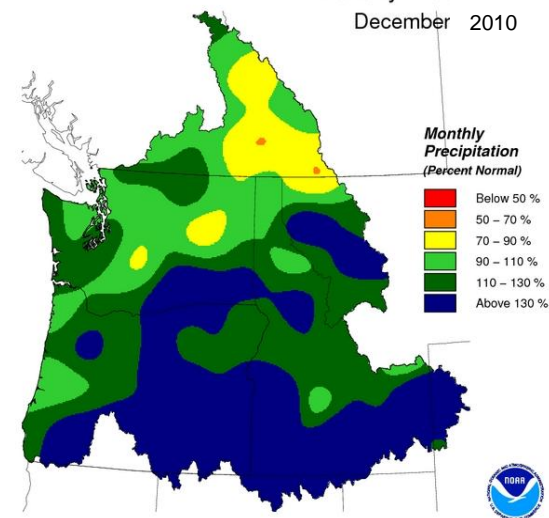
Monthly Precipitation
November 2010



Creation Time: Tue, Dec 7, 2010

Northwest River Forecast Center

Monthly Precipitation
December 2010



Creation Time: Fri, Jan 7, 2011

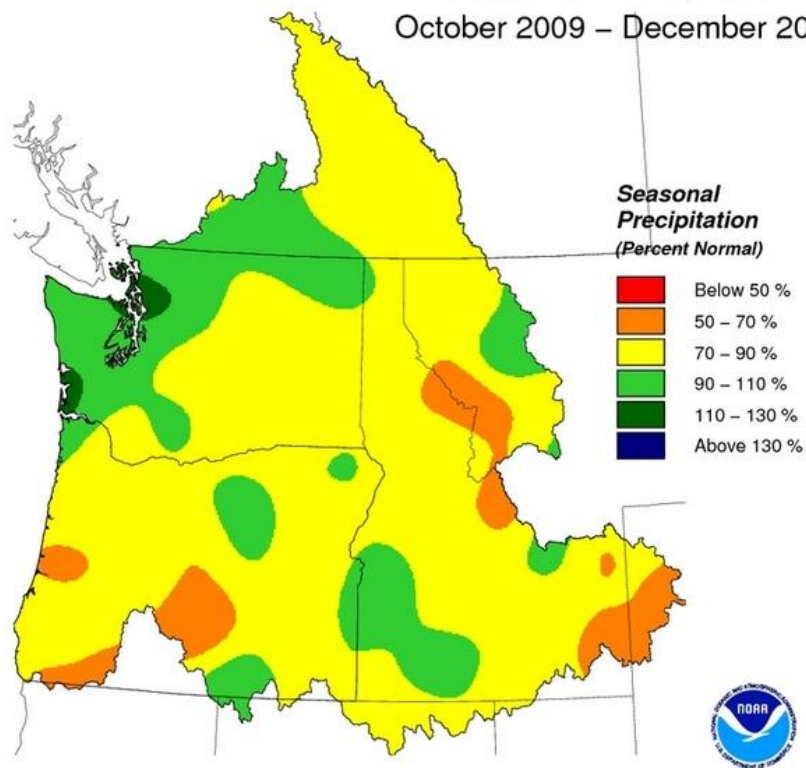
Northwest River Forecast Center



Observed Seasonal Precipitation



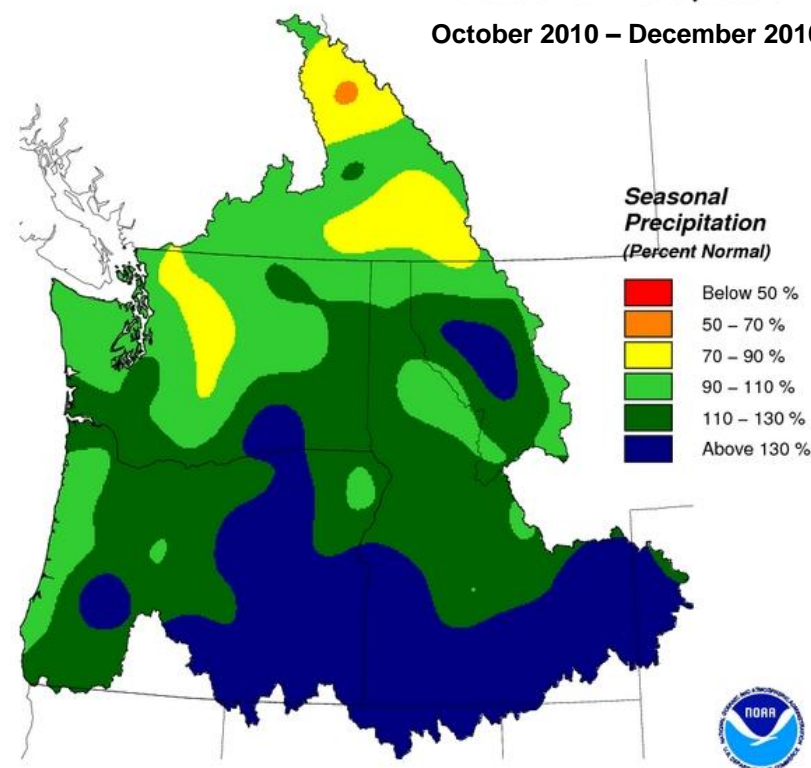
Seasonal Precipitation
October 2009 – December 2009



Creation Time: Mon, Mar 8, 2010

Northwest River Forecast Center

Seasonal Precipitation
October 2010 – December 2010



Creation Time: Fri, Jan 7, 2011

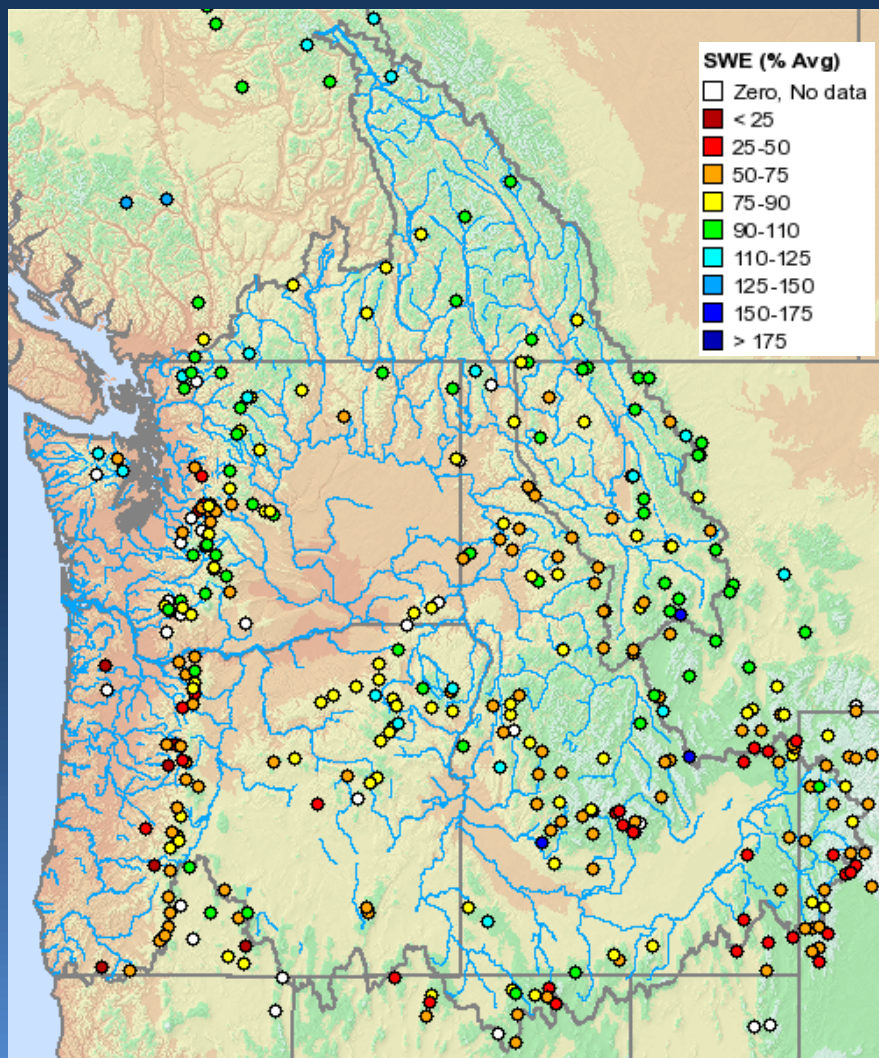
Northwest River Forecast Center



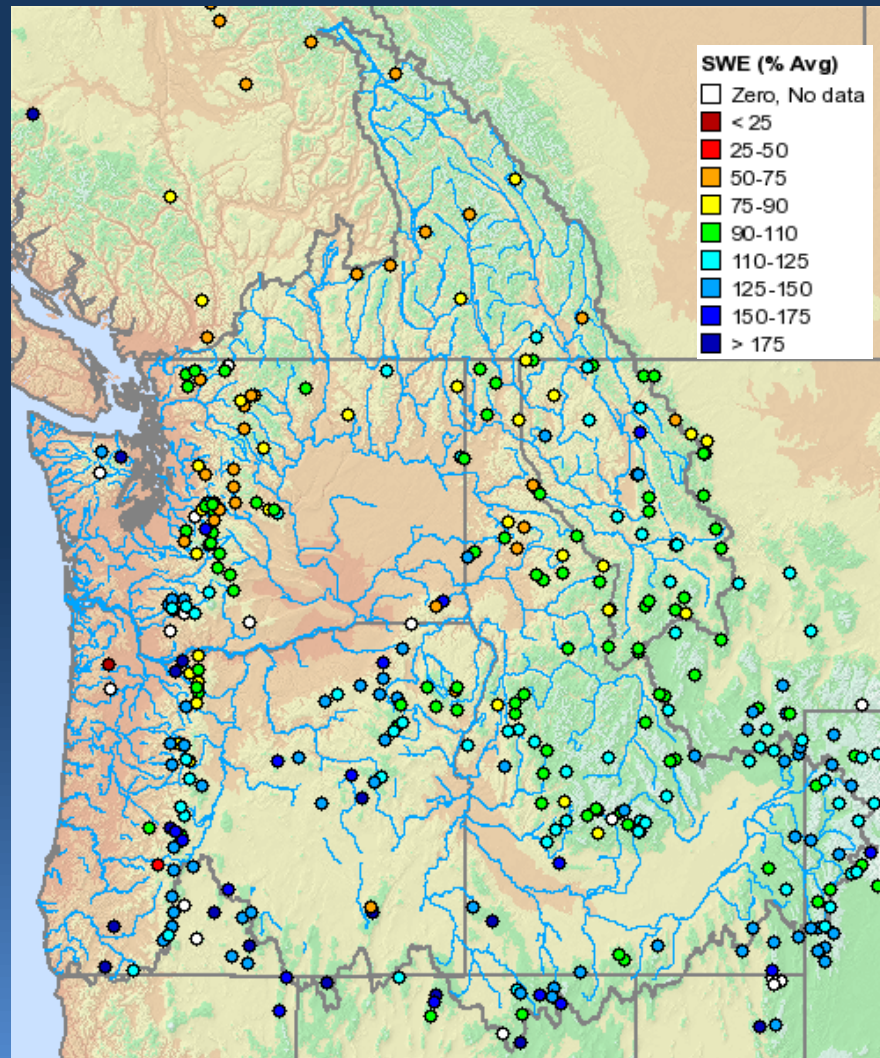
Current Snow Conditions



Jan 1, 2010

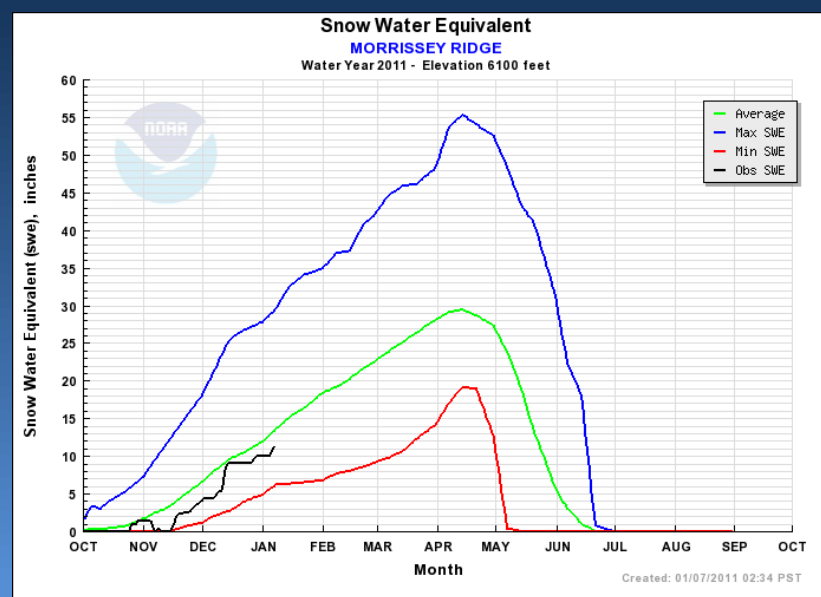
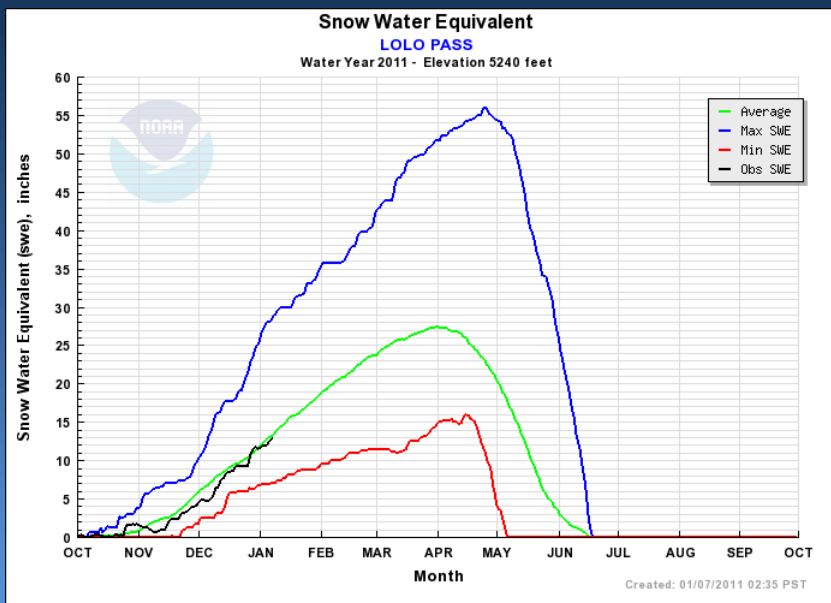
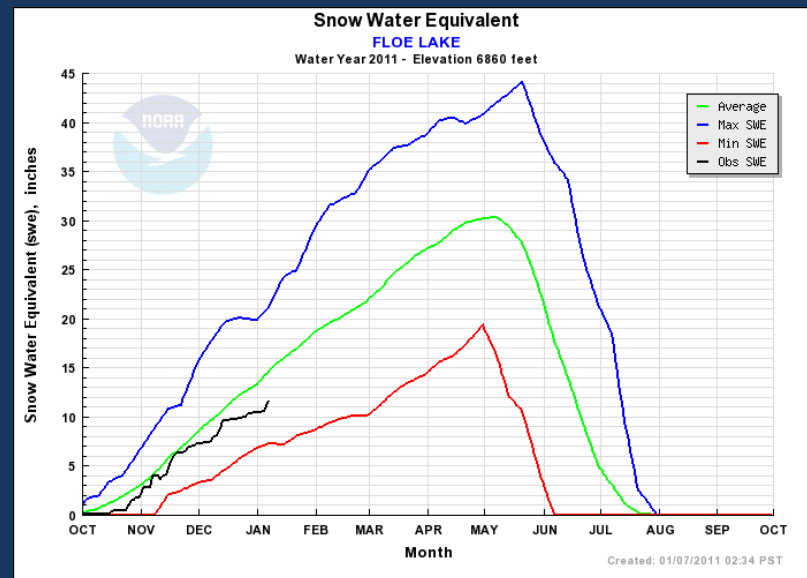
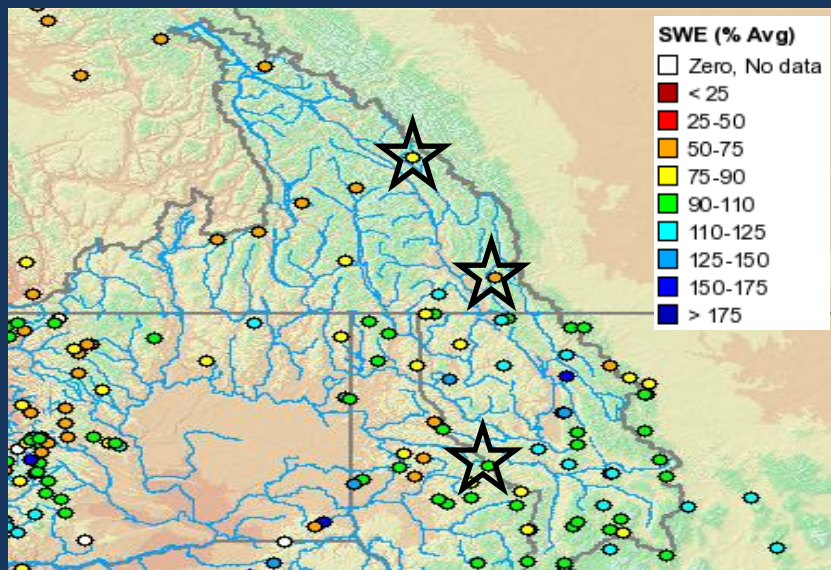


Jan 7, 2011



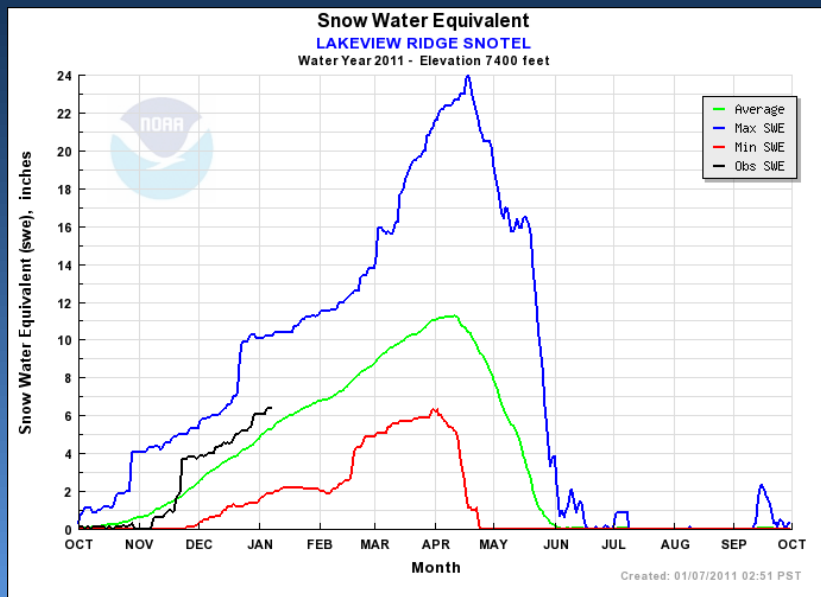
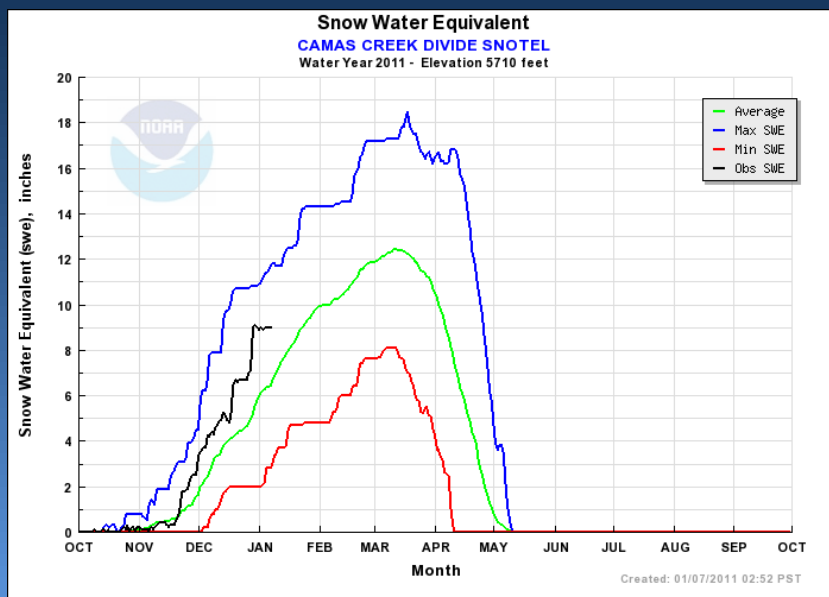
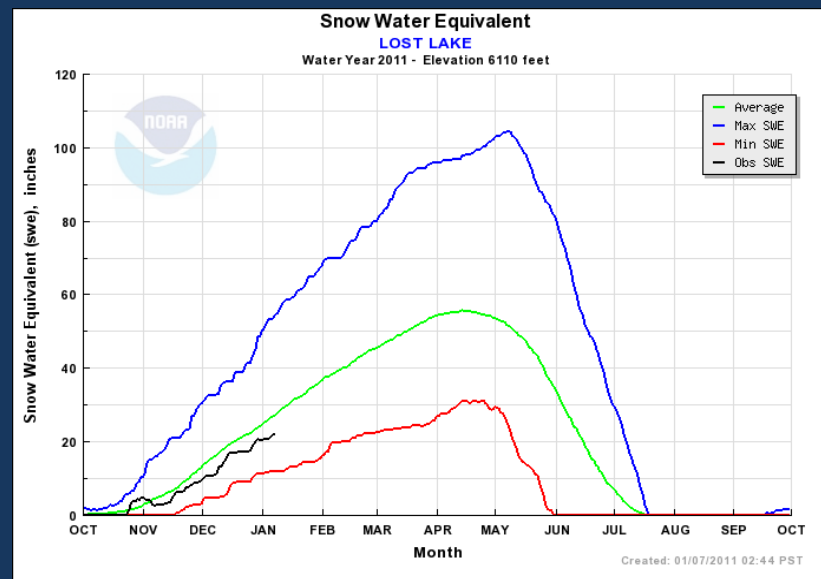
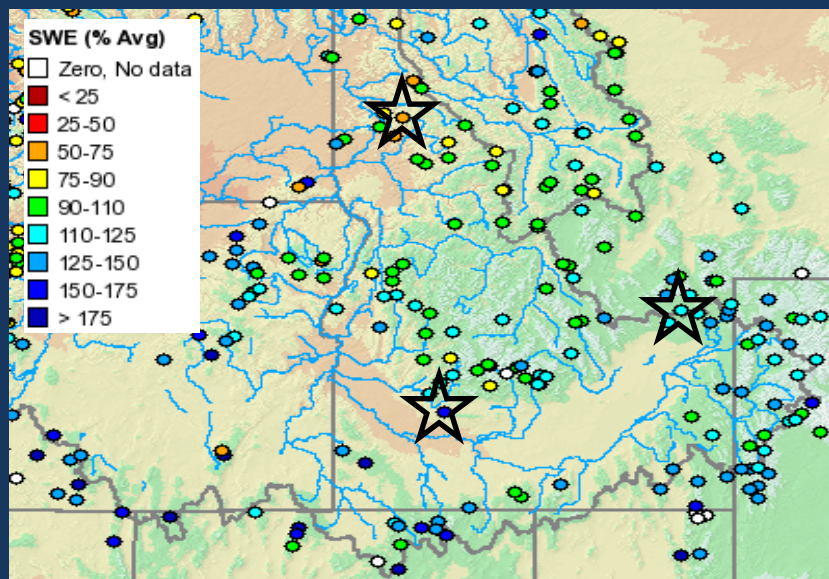


Upper Columbia Snow Conditions

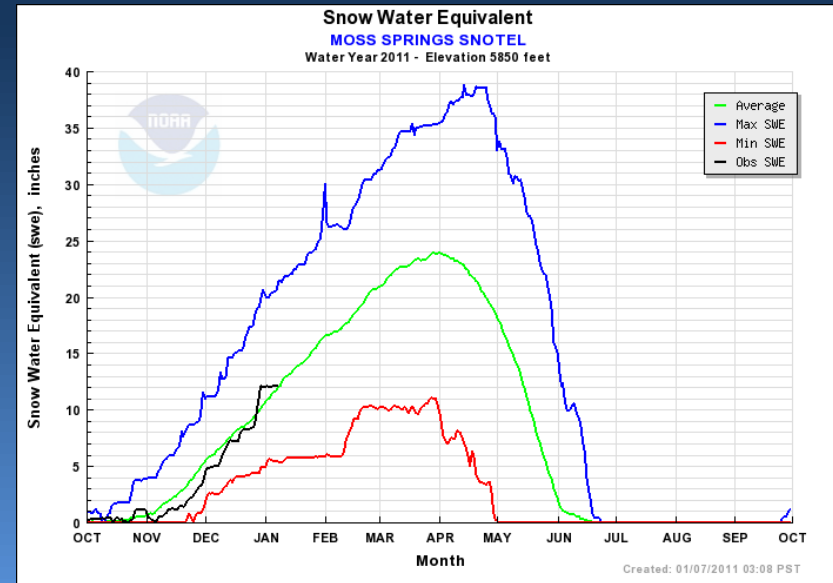
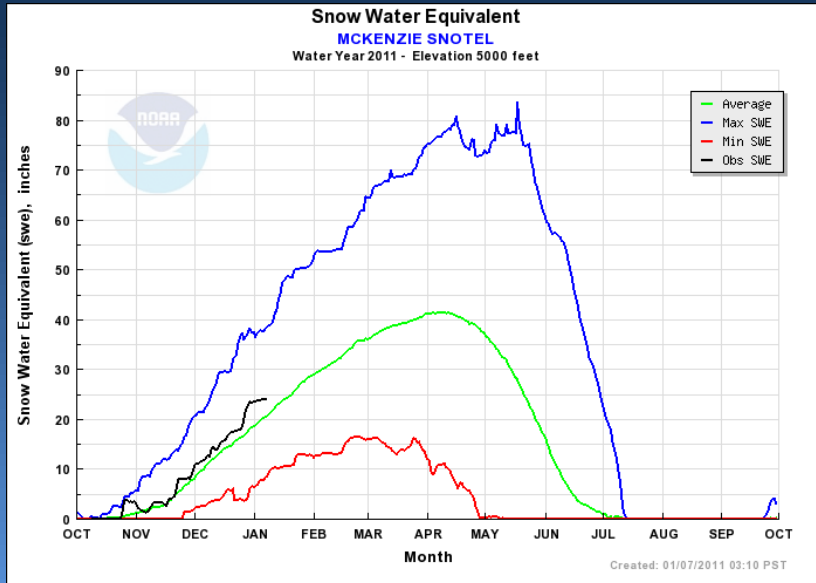
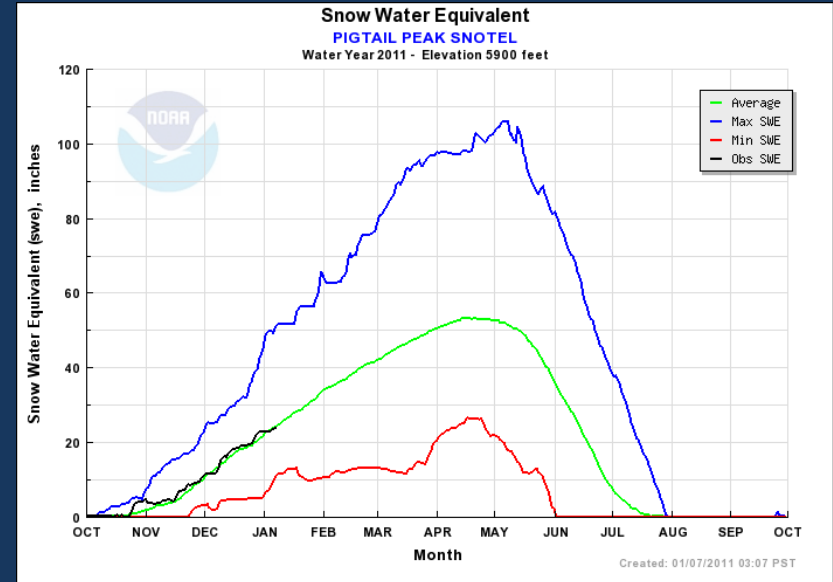
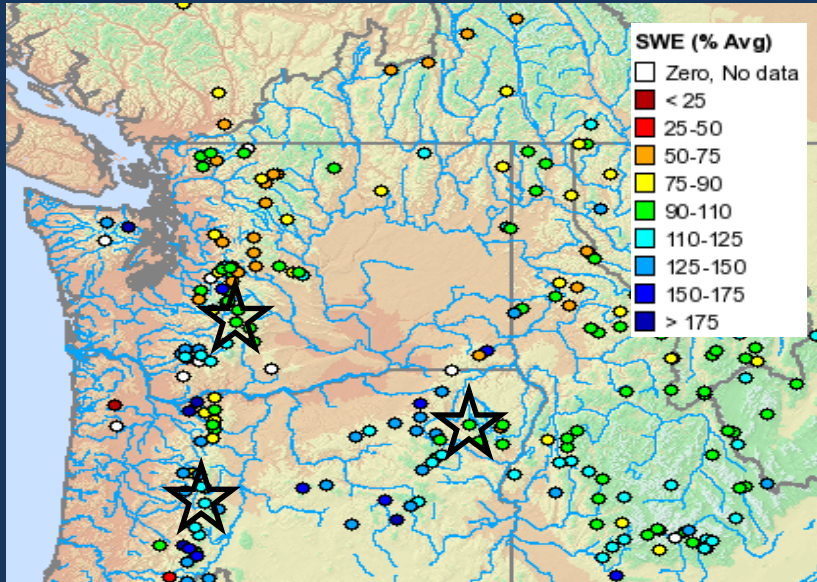




Snake River Snow Conditions



Lower Columbia Snow Conditions





Future Conditions



Climate Outlooks

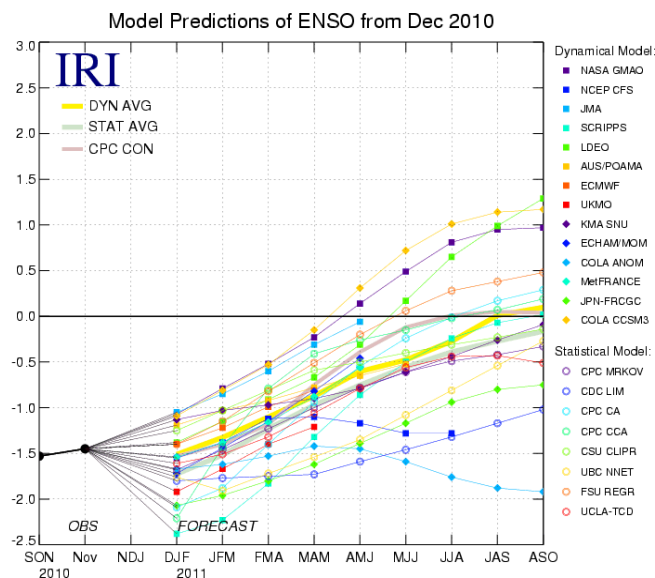
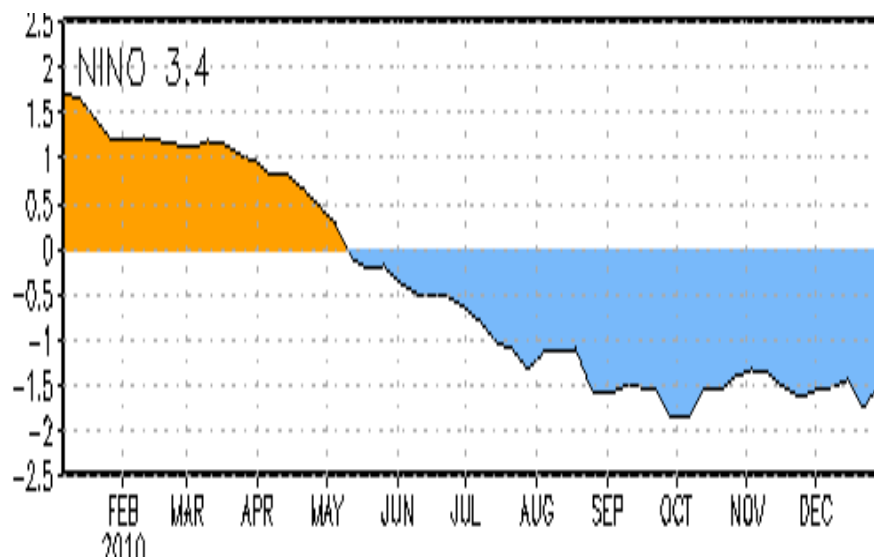
Precipitation Assumptions

Water Supply Forecasts

Enso: Observed and Forecast

SST Anomaly (Deg C)

Observed: SST 3.4 ~ 1.0 Deg C



CPC Synopsis: La Niña is expected to continue through spring of 2010.

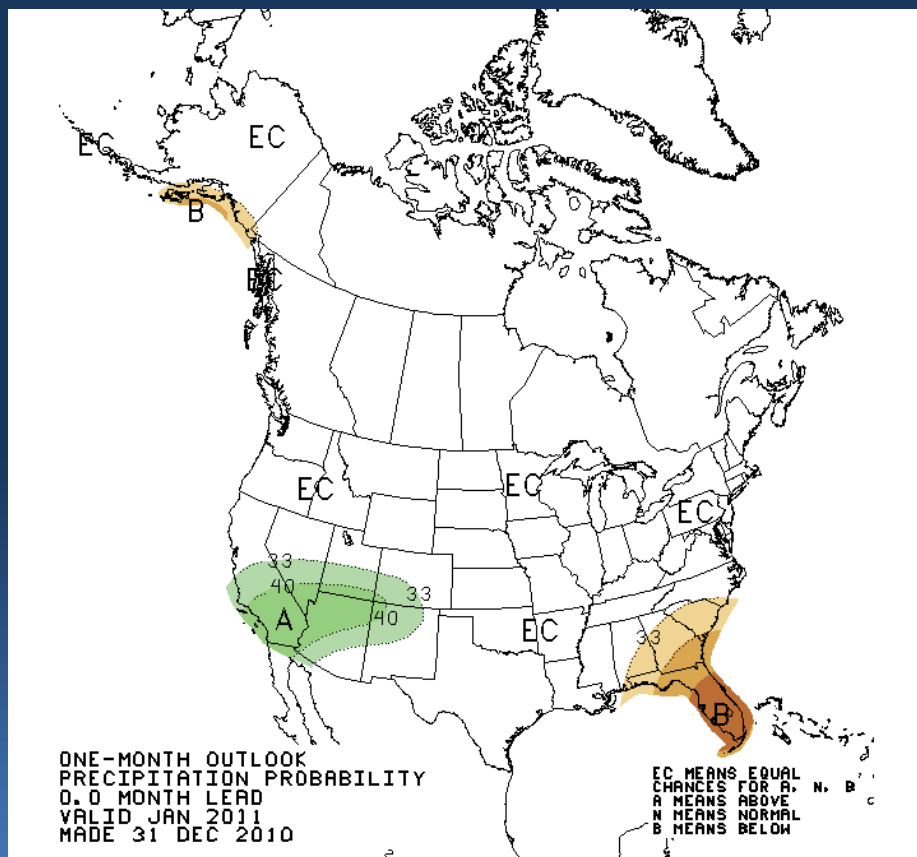
Source: El Niño/Southern Oscillation (ENSO) Diagnostic Discussion, Jan 6, 2010

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/index.shtml

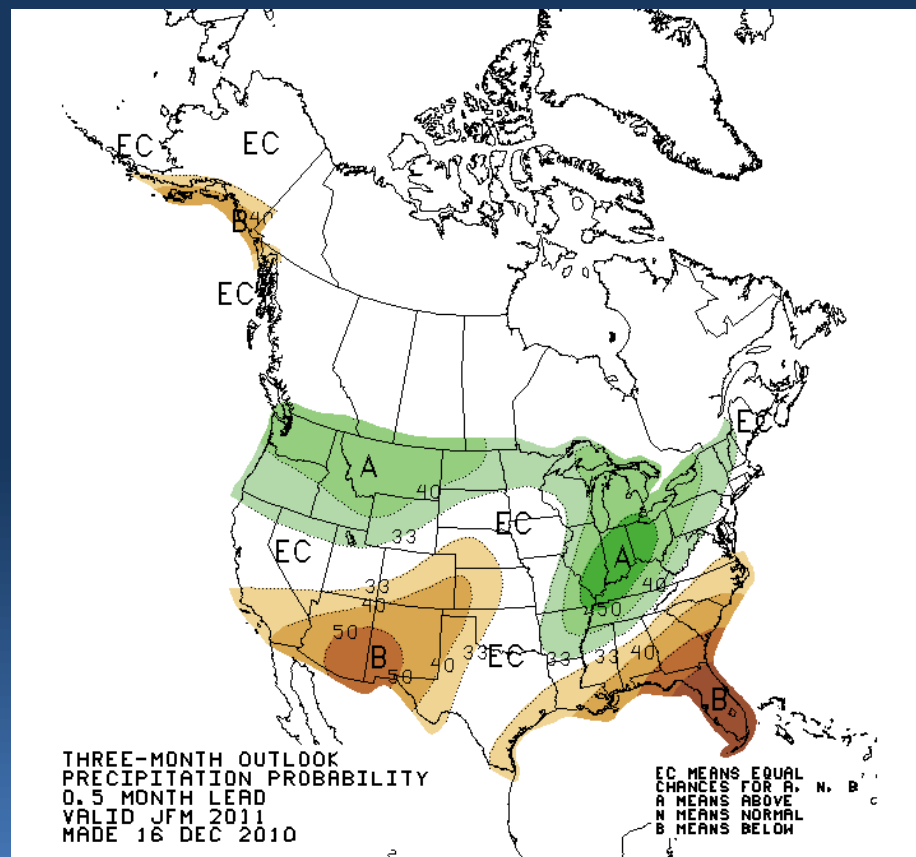


Climate Outlook: Precipitation

Current Month Outlook



Three Month Outlook

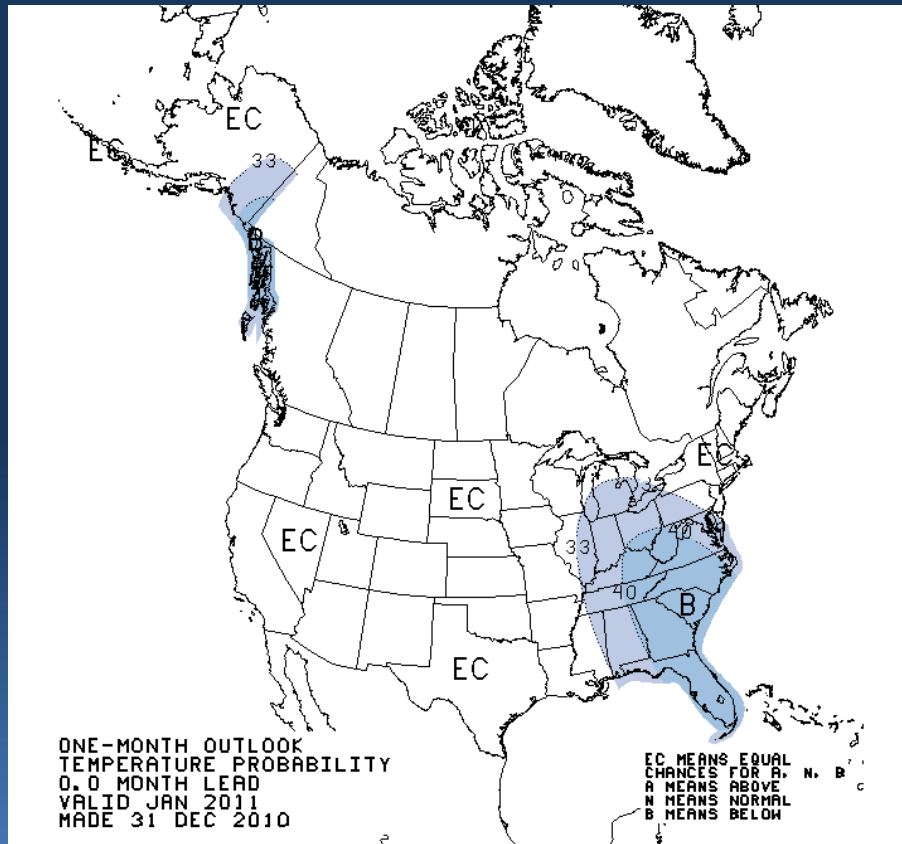




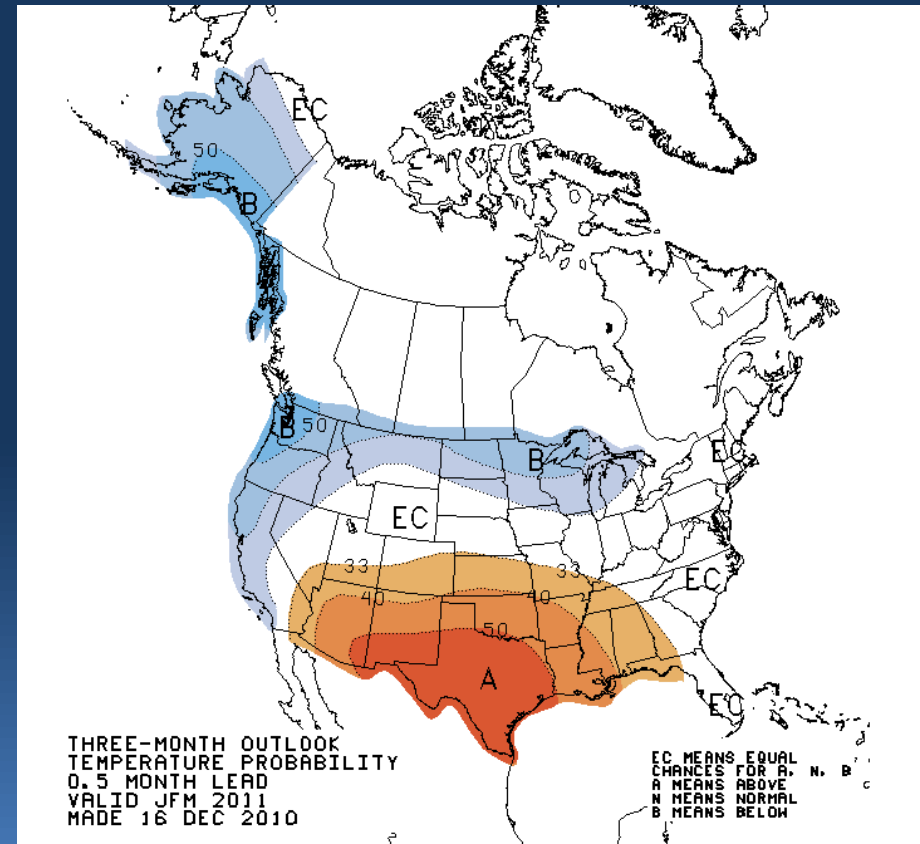
Climate Outlook: Temperature



Current Month Outlook



Three Month Outlook





Model Precipitation Assumptions



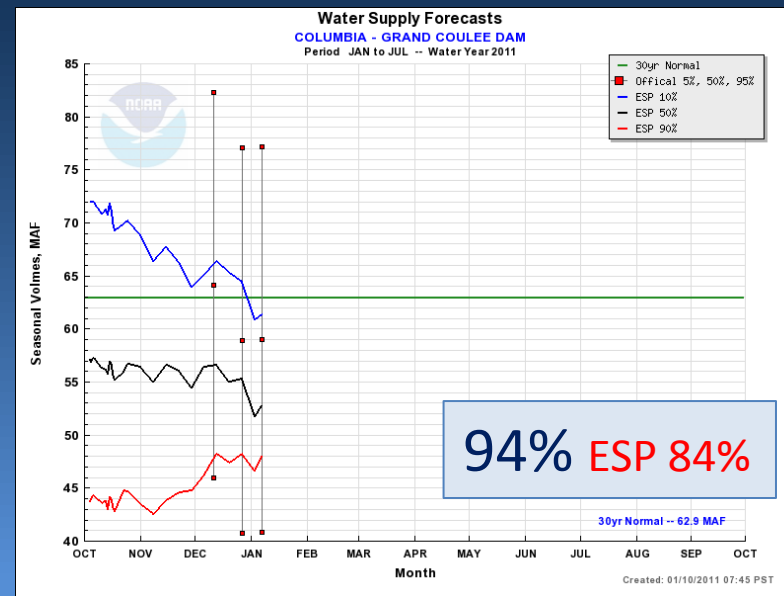
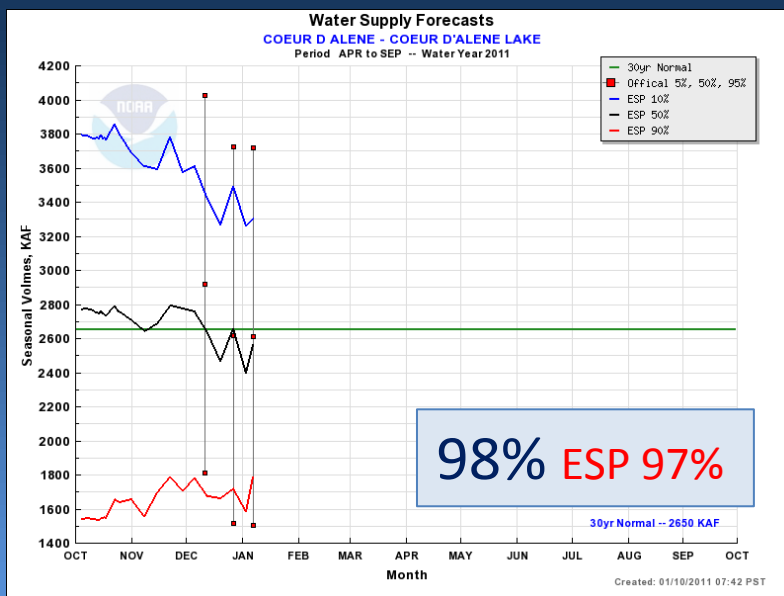
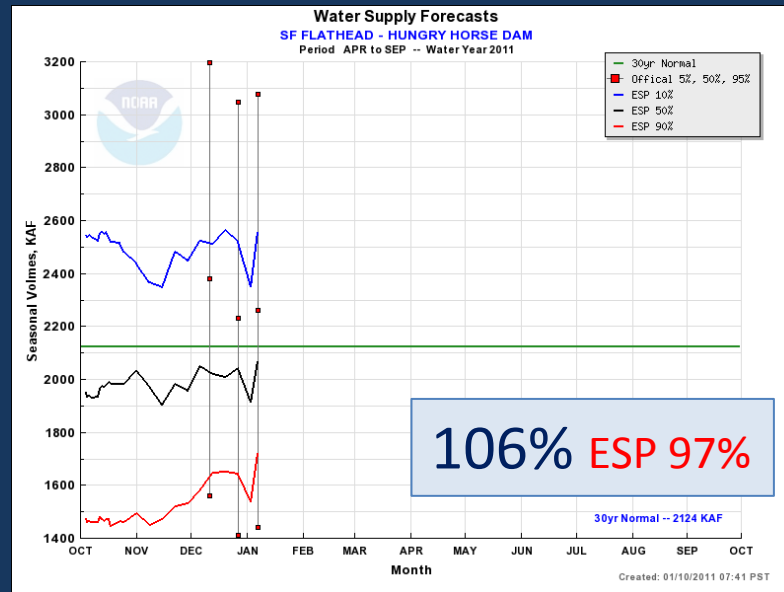
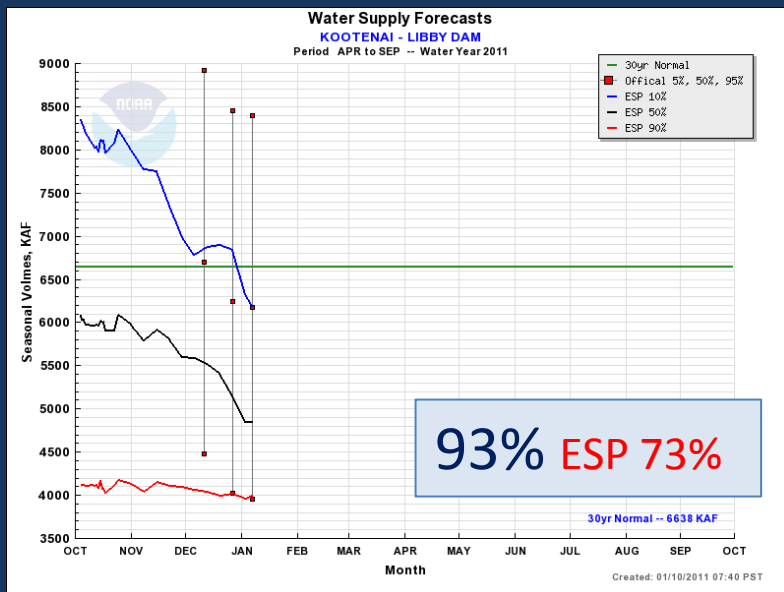
Jan Final Water Supply Forecast:

Feb Precipitation 100% of Normal

Mar – Jul Precipitation 100% of Normal

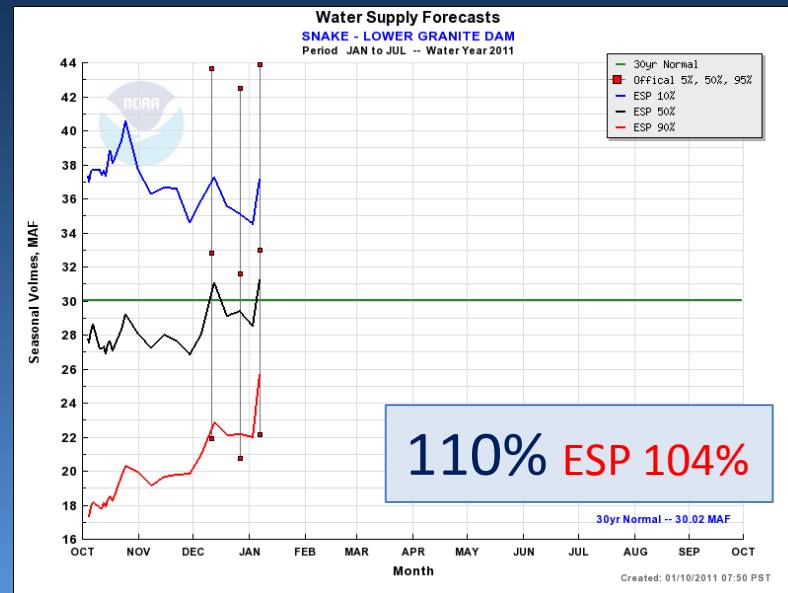
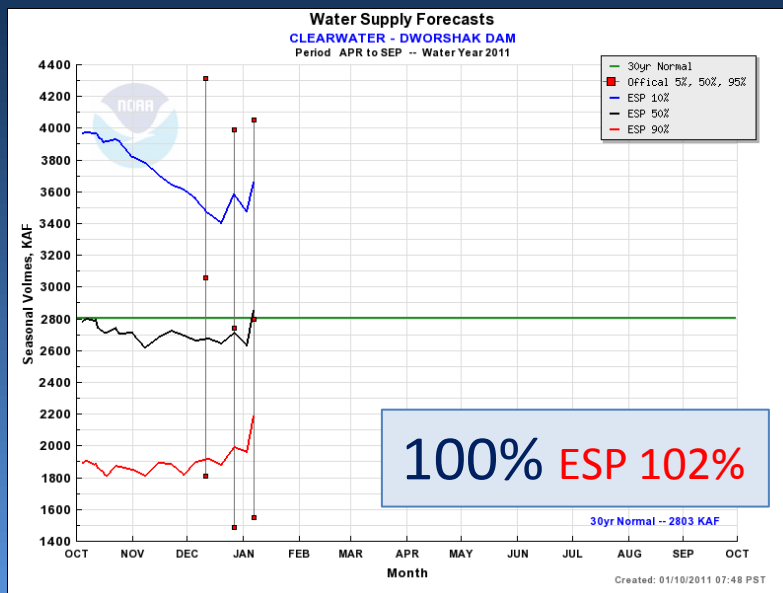
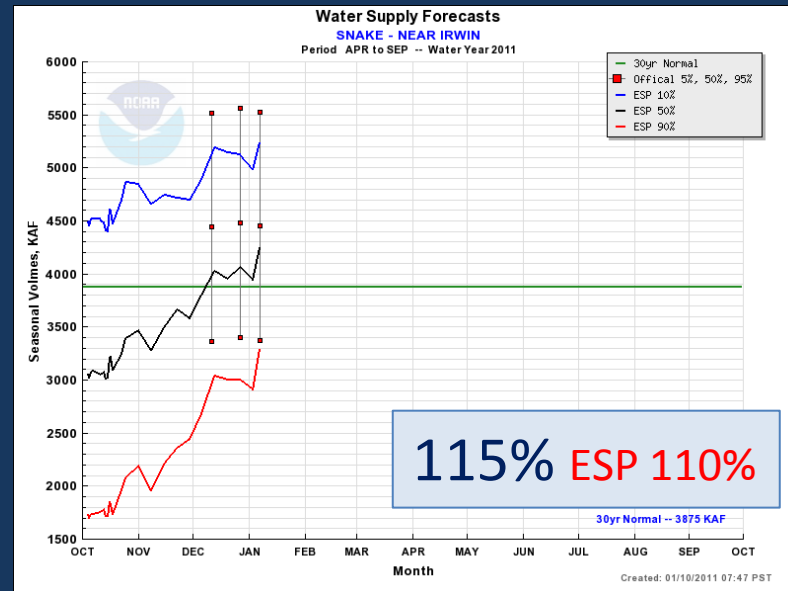
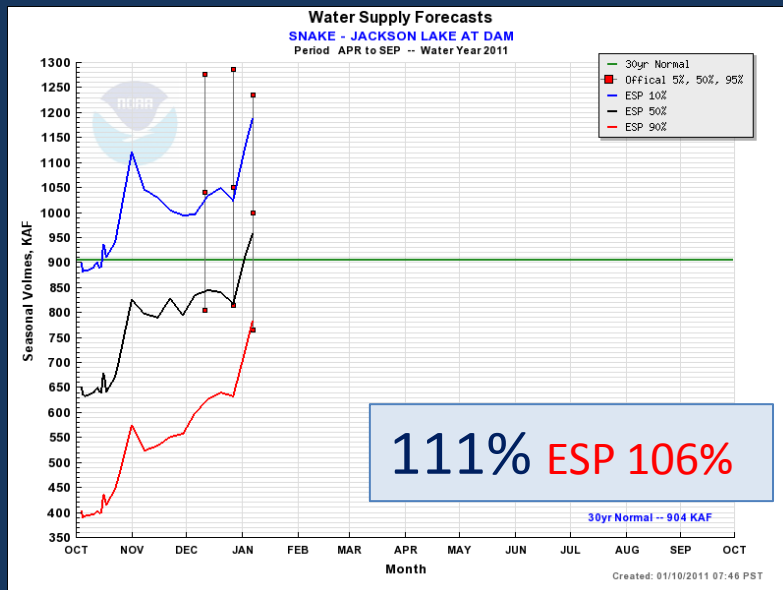


Water Supply Forecast: Upper Columbia



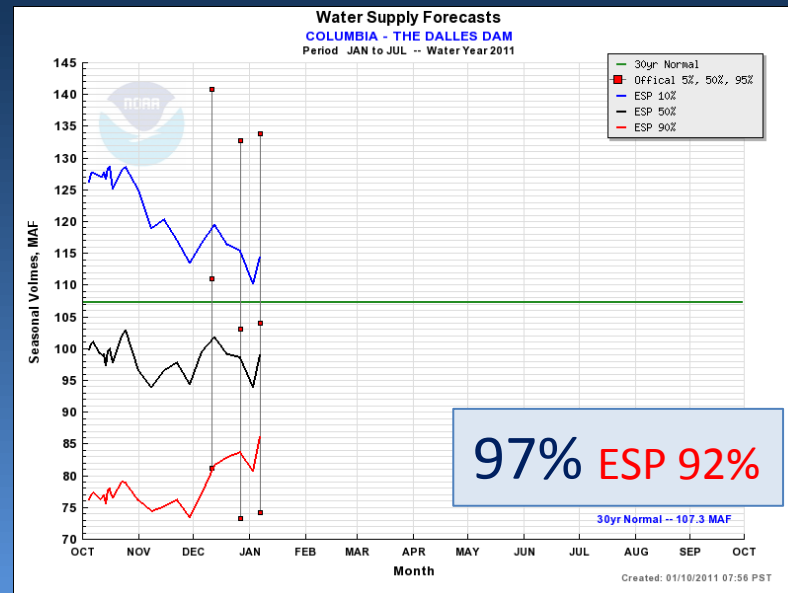
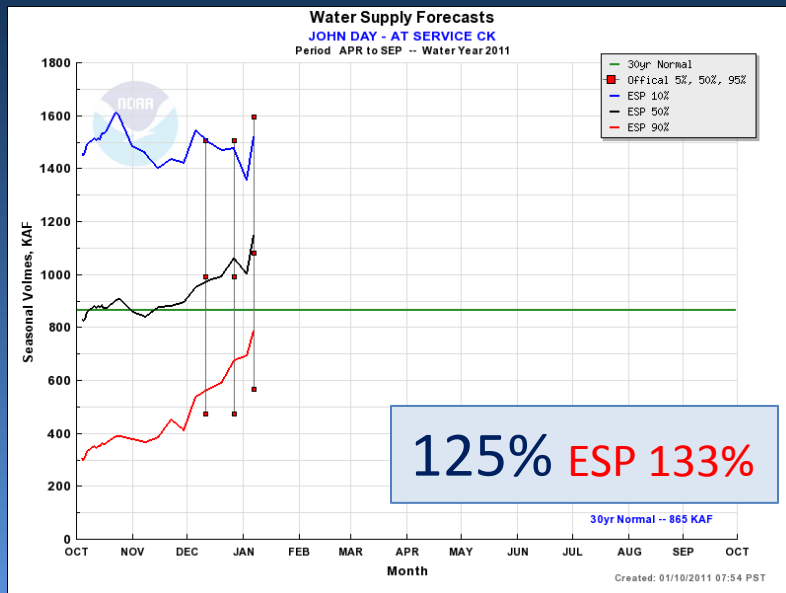
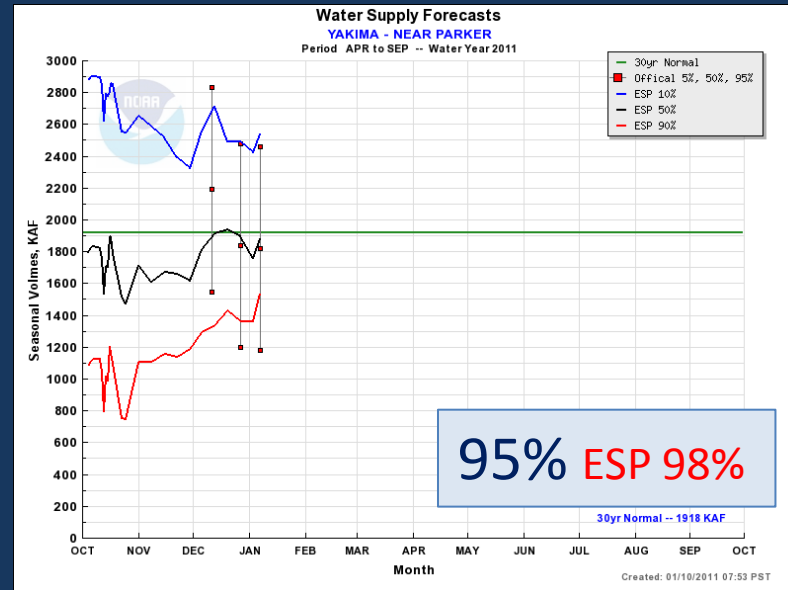
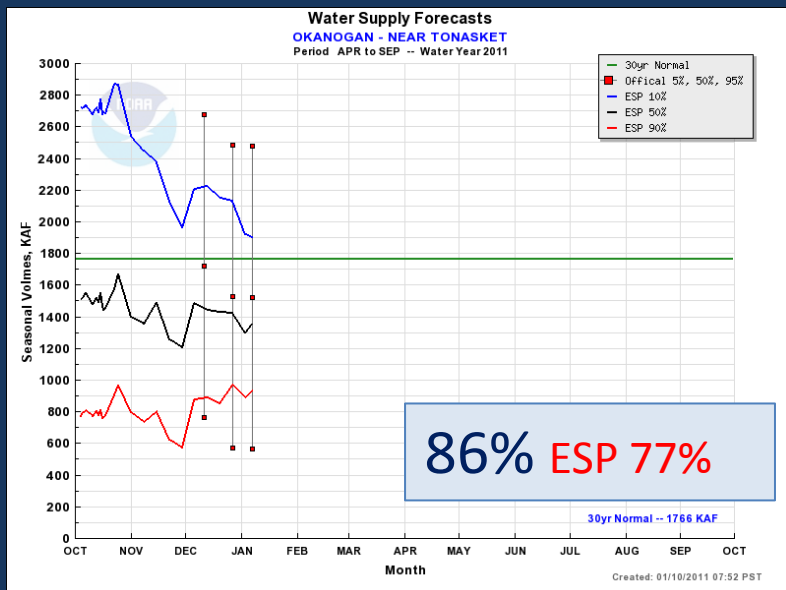


Water Supply Forecast: Snake





Water Supply Forecast: Lower Columbia





Water Supply Forecast: ESP Comparison



SNAKE - LOWER GRANITE DAM (LGDW1)

Forecasts for Water Year 2011

Official Water Supply Forecast <i>Issued: 2011-01-07</i>					ESP Water Supply Forecast <i>Issued: 2011-01-07</i>				
Forecast Period	Forecasts Are in KAF				Forecasts Are in KAF				30 Year Normal
	95 %	50 %	% Normal	05 %	90 %	50 %	% Normal	10 %	
APR-SEP	15628	26500	110	37372	20494	26009	108	30708	24140
APR-JUL	12828	23700	110	34572	18242	23150	107	27494	21550
APR-AUG	14228	25100	110	35972	19441	24729	108	29273	22870
JAN-JUL	22128	33000	110	43872	25710	31253	104	37179	30020

COLUMBIA - GRAND COULEE DAM (GCDW1)

Forecasts for Water Year 2011

Official Water Supply Forecast <i>Issued: 2011-01-07</i>					ESP Water Supply Forecast <i>Issued: 2011-01-07</i>				
Forecast Period	Forecasts Are in KAF				Forecasts Are in KAF				30 Year Normal
	95 %	50 %	% Normal	05 %	90 %	50 %	% Normal	10 %	
APR-SEP	41845	60000	94	78155	49489	55103	86	63605	63990
APR-JUL	32345	50500	94	68655	40973	45273	84	53248	53850
APR-AUG	38345	56500	94	74655	46257	51368	85	59209	60290
JAN-JUL	40845	59000	94	77155	47982	52763	84	61368	62900

COLUMBIA - THE DALLES DAM (TDA03)

Forecasts for Water Year 2011

Official Water Supply Forecast <i>Issued: 2011-01-07</i>					ESP Water Supply Forecast <i>Issued: 2011-01-07</i>				
Forecast Period	Forecasts Are in KAF				Forecasts Are in KAF				30 Year Normal
	95 %	50 %	% Normal	05 %	90 %	50 %	% Normal	10 %	
APR-SEP	66237	96000	97	125763	80227	92401	94	101880	98650
APR-JUL	52237	82000	97	111763	67863	78391	93	88559	84650
APR-AUG	60837	90600	97	120363	75121	86758	93	96560	93090
JAN-JUL	74237	104000	97	133763	86205	99041	92	114368	107300



NWRFC Water Supply Webpage

www.nwrfc.noaa.gov



Water Supply Forecast Release Schedule for 2010-2011 WY								
Type of Forecast	Month							
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Early Bird (Prelim Forecast)	30	27	24	31	28		2,30	
Official Forecast (Final)		7	7	7	7	6	7	8
Peak Flow Forecast		10	8	8	8	9	8	11
Mid-month Update	16	20	17	17	21	19	16	
Live Call		10	8	8	8	9		

Normal Release Time is in the Afternoon on Days Listed



NWRFC Water Supply Webpage

www.nwrfc.noaa.gov

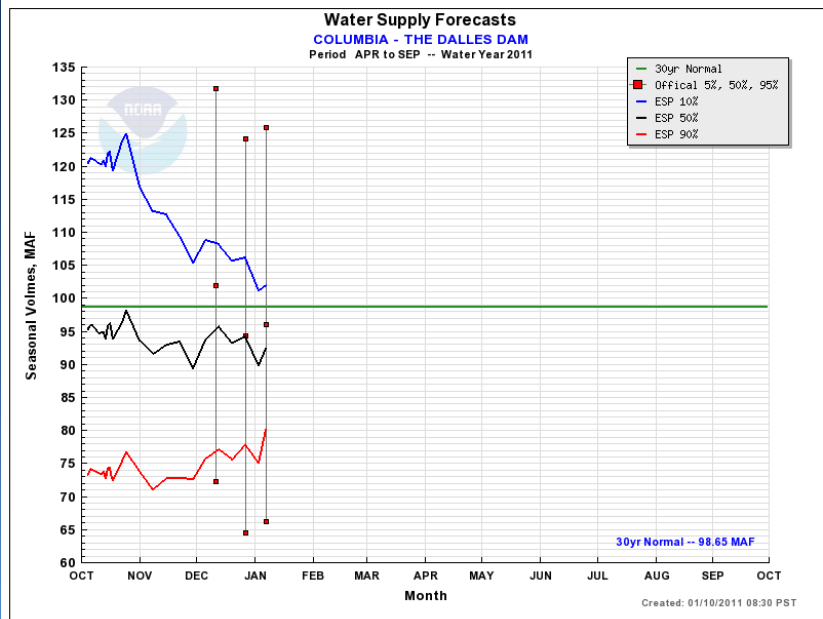


Northwest River Forecast Center Water Supply Forecasts

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COLUMBIA - THE DALLES DAM (TDA03) Forecasts for Water Year 2011

Forecast Period	Forecasts Are in KAF				Forecasts Are in KAF				30 Year Normal
	95 %	50 %	% Normal	05 %	90 %	50 %	% Normal	10 %	
APR-SEP	66237	96000	97	125763	80227	92401	94	101880	98650
APR-JUL	52237	82000	97	111763	67863	78391	93	88559	84650
APR-AUG	60837	90600	97	120363	75121	86758	93	96560	93090
JAN-JUL	74237	104000	97	133763	86205	99041	92	114368	107300



For Data Used in Plot Click Here: [CSV](#)

Base Forecast Periods

Apr-Jul
Apr-Sep

Additional Periods

- Main Stem
- Key Projects

Apr-Aug
Jan-July



Northwest River Forecast Center Water Supply Forecasts

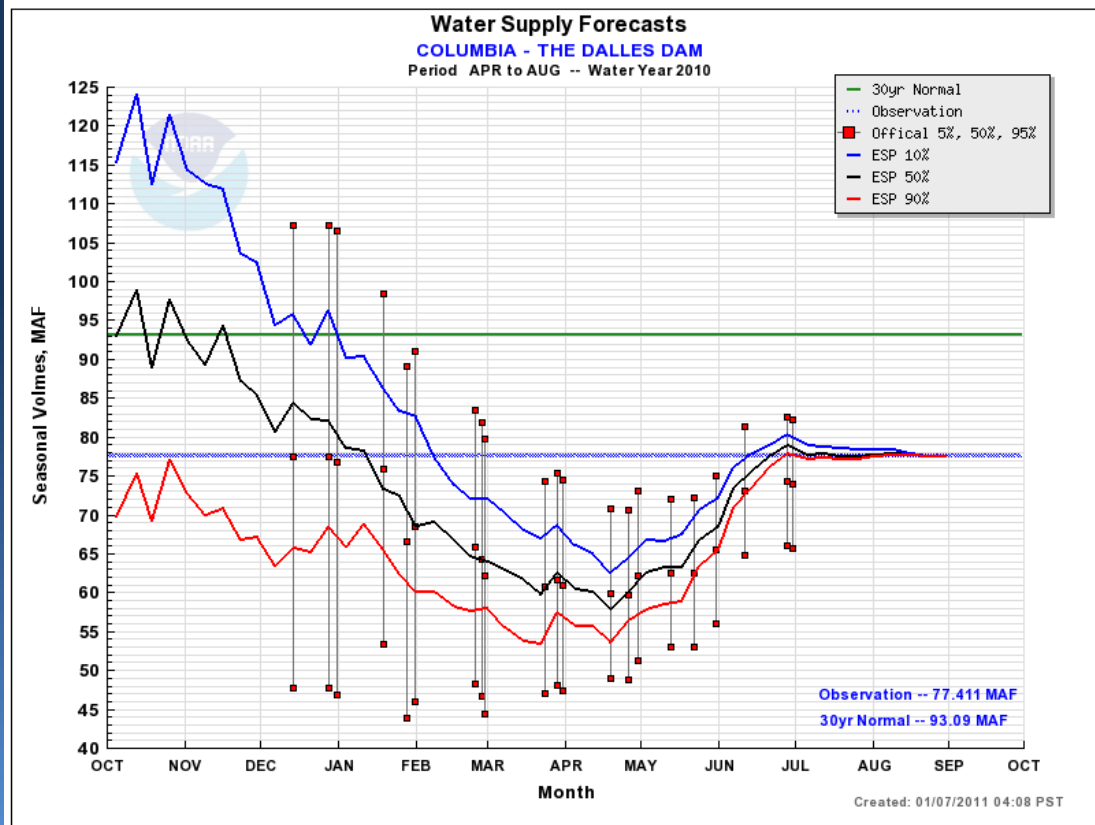
www.nwrfc.noaa.gov

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Select Water Year:

2010

COLUMBIA - THE DALLES DAM (TDA03) Forecasts for Water Year 2010



For Data Used In Plot Click Here: [CSV](#)

Plots Available for
WY 2004-Present

Archive tool also useful
for obtaining plots for
additional periods



Northwest River Forecast Center Water Supply Forecasts

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Select Period:

[APR-SEP](#) [Select](#)

COLUMBIA - THE DALLES DAM (TDA03)

Period Rankings - 1970 to 2011

APR-SEP Normal -- 98650 (KAF)

Rank	Year	Period Volume (KAF)	Percent of Normal	Exceedance Probability*
1	1997	140910.02	143	2.439 %
2	1974	139678.19	142	4.878 %
3	1972	134843.11	137	7.317 %
4	1971	126791.38	129	9.756 %
5	1976	122793.82	124	12.195 %
6	1982	122739.33	124	14.634 %
7	1999	117711.16	119	17.073 %
8	1996	116571.72	118	19.512 %
9	1984	110539.78	112	21.951 %
10	1975	108768.47	110	24.390 %
11	1983	107253.31	109	26.829 %
12	1991	106879.30	108	29.268 %
13	2006	101657.00	103	31.707 %
14	1978	100301.82	102	34.146 %
15	1990	98431.92	100	36.585 %
16	2002	98095.00	99	39.024 %
17	2008	97913.00	99	41.463 %
18	1981	97025.21	98	43.902 %
19	1998	96819.00	98	46.341 %
20	2011	96000.00	97	48.780 %
21	1986	93351.69	95	51.220 %
22	1980	93029.44	94	53.659 %
23	1995	93026.12	94	56.098 %
24	2000	91246.93	92	58.537 %
25	1989	88873.21	90	60.976 %
26	1993	88191.73	89	63.415 %
27	1985	86512.23	88	65.854 %
28	2009	85551.00	87	68.293 %
29	2010	82988.00	84	70.732 %
30	2007	82811.00	84	73.171 %
31	2004	80072.00	81	75.610 %
32	2003	77438.00	78	78.049 %
33	1979	77260.41	78	80.488 %
34	1988	73000.90	74	82.927 %
35	2005	72732.00	74	85.366 %
36	1994	71845.16	73	87.805 %
37	1987	70894.99	72	90.244 %
38	1973	65400.72	66	92.683 %
39	1992	64712.94	66	95.122 %
40	1977	54071.24	55	97.561 %

*Exceedance Probability: The probability that a specific seasonal volume will be exceeded.

Ranking tool places current
'official' forecast in historical context

Jan forecast volume for The Dalles:

Near normal

Rank of 20 out of 39 years



Northwest River Forecast Center

Water Supply Forecasts

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Data is Promotional beyond WY 2000

COLUMBIA - THE DALLES DAM (TDA03) Month Volumes in KAF

Calendar Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1970									4735.71	4817.81	5172.55	
1971	8151.20	9772.71	8382.59	15270.33	39075.68	37333.06	19360.46	10116.14	5635.70	5587.12	5290.24	5068.43
1972	6532.97	7669.03	19204.57	15067.25	34723.96	45582.49	21590.24	10924.00	5955.19	5791.63	4771.55	5567.18
1973	5834.75	4187.02	6313.92	7190.81	18247.75	18269.33	10949.36	6400.68	4343.79	4290.28	6840.88	8745.47
1974	13257.27	8428.42	10845.37	20183.37	29779.03	49488.36	24312.69	10432.12	5482.62	4436.17	4239.42	4417.64
1975	5294.25	4695.86	7482.53	10002.62	26457.48	36434.48	21128.63	8706.94	6038.42	6144.35	7112.99	11241.89
1976	8128.80	6653.97	7693.11	16628.25	35897.85	26808.49	20738.86	14099.12	8721.26	5178.17	4235.49	3858.99
1977	3542.07	3241.50	3597.18	7124.25	13603.18	14829.65	7355.60	6568.99	4599.68	3888.50	4270.82	8516.48
1978	5654.19	5372.63	9251.06	15253.09	24145.86	27886.48	17262.96	8041.19	7712.63	5315.99	4747.53	3495.50
1979	3755.31	5155.34	8007.63	10032.09	25501.77	19747.92	10822.96	6448.10	4706.68	3883.83	3050.38	4609.95
1980	4622.15	5000.05	6810.00	14702.59	30928.50	23476.00	11826.92	6398.41	5697.01	5109.19	5299.78	8707.22
1981	7654.15	7929.15	7443.73	10944.24	25553.99	27120.16	18045.81	9748.93	5512.07	5451.10	5241.38	6154.76
1982	5646.55	11675.07	12101.98	13946.87	29978.80	30089.04	22382.20	9945.11	7397.32	6441.19	5541.12	6667.10
1983	7984.77	8607.80	15451.84	15220.02	28635.22	28790.11	18687.04	9925.05	5995.88	3972.29	8011.31	6191.52
1984	9374.38	7230.88	11955.59	16662.54	23837.55	35712.98	18821.69	9120.19	6384.83	6643.83	6428.19	5130.46
1985	4831.75	4751.21	6374.11	15358.04	26900.37	21925.44	10183.87	6182.87	5951.64	6222.14	6518.18	4454.23
1986	5259.81	9660.21	10871.10	16010.76	24590.53	27755.13	12230.94	7527.40	5136.92	5537.09	5891.58	4955.27
1987	4339.94	4491.34	8959.59	12114.85	23558.88	15492.24	9668.86	5968.17	4191.99	3393.97	3101.50	3531.19
1988	3594.05	3701.55	5258.60	13118.24	20264.24	19432.48	10169.30	6004.76	4011.87	4784.76	5062.76	4287.99
1989	4249.38	3651.01	9191.91	16425.08	24535.96	23680.50	11287.43	7700.06	5244.18	4654.68	7124.19	6248.52
1990	6045.66	4802.60	7085.07	16191.92	20872.45	30167.16	17206.66	9006.92	4986.81	5172.35	9058.04	6674.28
1991	6146.71	7956.72	7749.11	13025.50	27682.42	29501.97	20897.48	10418.44	5353.49	3941.00	4770.48	4742.55
1992	4719.01	5845.90	7781.82	11056.67	19180.60	15509.00	9451.83	5581.10	3933.74	4597.94	4075.40	3557.80
1993	4084.97	3527.92	8635.74	12732.84	28447.01	20663.98	12726.26	8397.28	5224.37	4456.24	3407.23	4020.92
1994	4269.64	3429.81	6124.55	13839.49	21109.43	16573.22	10952.73	5712.41	3657.86	3458.82	3405.37	4410.80
1995	5642.40	9717.55	11258.63	10884.08	24926.09	28682.62	15063.86	8096.28	5393.20	6429.57	10196.71	14289.07
1996	9126.38	15982.16	12349.74	20488.89	27186.22	34415.17	20096.71	8916.99	5457.74	5340.78	5261.29	6864.90
1997	11523.41	9511.19	14485.23	19814.38	41895.93	41378.62	20257.15	9651.01	7912.93	9230.18	7086.18	5771.84
1998	6189.88	6308.15	9280.20	13266.64	33370.80	23823.73	13935.64	7293.82	5128.37	4316.12	5181.56	6406.15
1999	7939.33	7076.79	12231.12	15364.32	26301.64	35910.92	21905.93	12501.57	5726.78	5233.68	8493.39	7499.40
2000	5896.57	6851.89	9103.83	17435.67	23280.28	22880.73	14897.02	7360.96	5392.26			
2001										3422.00	4612.00	4206.00
2002	5372.00	4658.00	6191.00	13657.00	23100.00	33489.00	17286.00	6273.00	4290.00	3304.00	3372.00	3536.00
2003	4797.00	5663.00	9702.00	13066.00	20527.00	24603.00	9930.00	5642.00	3670.00	5878.00	4638.00	4366.00
2004	4435.00	4980.00	7977.00	13765.00	20814.00	19909.00	11074.00	7401.00	7109.00	5902.00	5409.00	6564.00
2005	7120.00	5594.00	8049.00	10565.00	21608.00	18798.00	11615.00	5886.00	4280.00	6167.00	4967.00	5052.00
2006	8938.00	5784.00	8013.00	18358.00	34168.00	27714.00	11697.00	5689.00	4031.00	3594.00	7765.00	5513.00
2007	5209.00	5357.00	12068.00	12777.00	23816.00	22826.00	13685.00	6835.00	3872.00	4704.00	4460.00	4842.00
2008	4042.00	4078.00	5924.00	7129.00	31292.00	30884.00	15860.00	8033.00	4715.00	4635.00	5794.00	4300.00
2009	6310.00	4116.00	6413.00	12601.00	23943.00	25281.00	11580.00	7366.00	4780.00	4229.00	4554.00	3938.00
2010	4869.00	4134.00	5325.00	9739.00	17687.00	29041.00	13923.00	7021.00	5577.00	5321.00	5308.00	
30-Year Normal 1971-2000	6313.36	6762.88	9576.38	14174.55	26688.98	27978.68	15807.22	8436.50	5563.24	5086.62	5617.43	6051.67

Monthly Flow Volumes (Runoff)
30 YR ('71-'00) Normals



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COLUMBIA - THE DALLES DAM (TDAO3) Adjustments Used to Calculate Unadjusted Flow

Observed Runoff Volume at COLUMBIA - THE DALLES DAM (TDAO3)

- Plus the Change in Lake Storage Volume at COLUMBIA - MICA DAM (MCDQ2)
- Plus the Change in Lake Storage Volume at COLUMBIA - REVELSTOKE DAM (REVQ2)
- Plus the Change in Lake Storage Volume at COLUMBIA - ARROW LAKES AT NAKUSP (NAKQ2)
- Plus the Change in Lake Storage Volume at COLUMBIA - ARROW RESERVOIR NEAR FAUQUIER (FORQ2)
- Plus the Change in Lake Storage Volume at KOOTENAI - LIBBY DAM (LYDM8)
- Plus the Change in Lake Storage Volume at DUNCAN - DUNCAN DAM (DCDQ2)
- Plus the Change in Lake Storage Volume at KOOTENAI - KOOTENAI LAKE AT QUEENS BAY (QBYQ2)
- Plus the Change in Lake Storage Volume at SF FLATHEAD - HUNGRY HORSE DAM (HHWM8)
- Plus the Change in Lake Storage Volume at FLATHEAD - KERR DAM (KERM8)
- Plus the Change in Lake Storage Volume at PEND OREILLE - PEND OREILLE LAKE NEAR HOPE (HOP11)
- Plus the Change in Lake Storage Volume at PRIEST - NEAR PRIEST RIVER (PRT11)
- Plus the Change in Lake Storage Volume at CLARK FORK - NOXON RAPIDS DAM (NOXM8)
- Plus the Change in Lake Storage Volume at COEUR D ALENE - COEUR D'ALENE LAKE (COE11)
- Plus the Change in Lake Storage Volume at SPOKANE - AT LONGLAKE (LLKW1)
- Plus the Observed Runoff Volume at FEEDER CANAL AT GRAND COULEE (BNKW1)
- Plus the Change in Lake Storage Volume at COLUMBIA - GRAND COULEE DAM (GCDW1)
- Plus the Change in Lake Storage Volume at CHELAN - LAKE CHELAN DAM (CHDW1)
- Plus the Change in Lake Storage Volume at SNAKE - BROWNLEE DAM (BRNI1)
- Plus the Change in Lake Storage Volume at CLEARWATER - DWORSHAK DAM (DWRI1)
- Plus the Change in Lake Storage Volume at COLUMBIA - JOHN DAY DAM (JDAO3)



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Select Water Year:

2010 Select

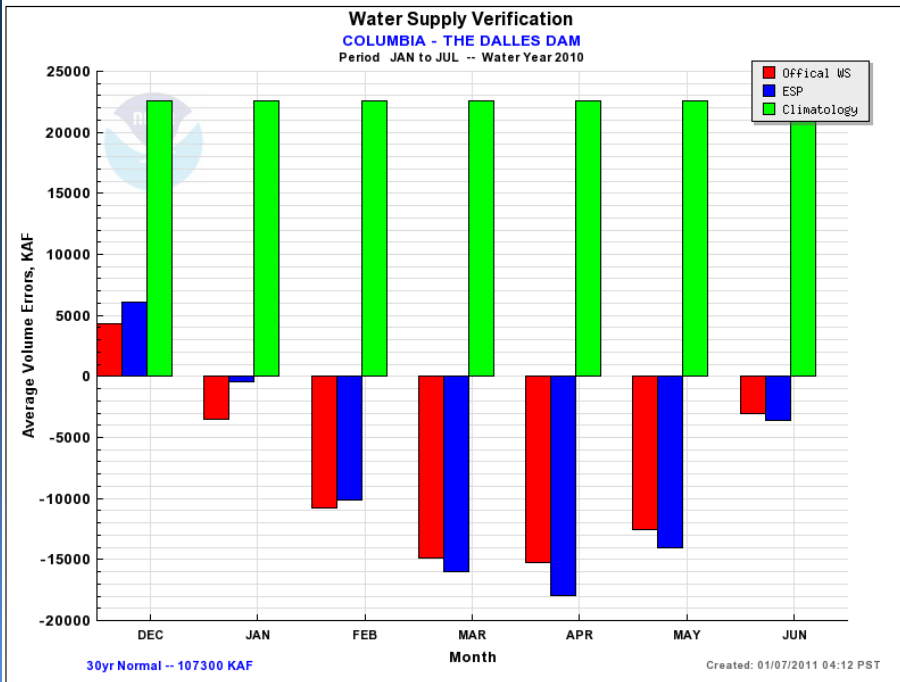
COLUMBIA - THE DALLES DAM (TDA03)

Verification for Water Year 2010

Official Water Supply Forecast

Forecast Period	Average Errors Are In KAF							Average Errors Are In KAF							
	Dec	Jan	Feb	Mar	Apr	May	Jun	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
JAN-JUL	4315	-3485	-10818	-14918	-15285	-12552	-3018	6124	-432	-10154	-15975	-17991	-14080	-3592	-170
APR-AUG	-178	-7111	-13311	-16311	-16811	-13878	-3611	4943	-1799	-10234	-15255	-17807	-13459	-2646	250
APR-JUL	-190	-6457	-12157	-14790	-15257	-12524	-2990	3863	-2741	-10871	-15932	-17991	-14080	-3592	-170
APR-SEP	-1155	-8488	-15088	-18288	-18755	-15688	-4788	5022	-1957	-10325	-15579	-18546	-14123	-2805	-236

ESP Water Supply Forecast



Climatology Forecast = Normal Runoff

AMS SHORT COURSE: HYDROLOGIC PREDICTION AND VERIFICATION TECHNIQUES WITH A FOCUS ON WATER SUPPLY

23 JANUARY 2011

WASHINGTON STATE CONVENTION CENTER

SEATTLE, WA

ORGANIZERS

Marina M. Timofeyeva, Andy Wood, Kevin Werner, Barbara Brown, Thomas Adams, David Bright

CO-SPONSORED BY

The AMS Hydrology Committee, Chair: Bart Nijssen

The AMS Committee on Probability and Statistics, Chair: Richard W. Katz

FINANCIAL SUPPORT PROVIDED BY

NOAA/NWS Office of Hydrologic Development

NOAA/NWS Western Region Headquarters

11:00 A.M.

**ENSEMBLE STREAMFLOW PREDICTION (ESP)
INTRODUCTION.** NOAA/NWS Northwest River
Forecast Center (NWRFC), Portland, OR; and
CBRFC

11:00 A.M.

ESP: VERIFICATION AND RECENT ADVANCES.
Julie Demargne and James Brown, NOAA/NWS
Office of Hydrologic Development, Silver Spring,
MD

<http://www.cbrfc.noaa.gov/shortcourse/AMSshortcourse.pdf>